# FUTURE AVIATION FUELS OVERVIEW

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This initial session focuses on the outlook for aviation fuels through the turn of the century and beyond. This is certainly an ambitious topic considering the turbulence in the fuel supply industry during the 1970's and the uncertainties in future petroleum supplies, syncrude production, alternative energy sources, product demand, and Government regulation or intervention. However, the aviation community must address this topic if the continued health and growth of the air transportation industry is to be assured.

The general objectives of the NASA Lewis Alternative Aviation Fuels Research Program are to evaluate the potential characteristics of future jet aircraft fuels, to determine the effects of those fuels on engine and fuel system components, and to evolve component technology to use those fuels. The general structure of the program is illustrated in figure 1. The element labeled "identification of future fuels" encompasses activities to determine the range of probable properties of future fuels and to examine the effect of varying fuel properties on the fuel supply system. This element encompasses most of the activities in the program which are appropriate to this session. The activities directed toward identifying the effects of broadened-property fuels on aviation systems and evolving technology to use those fuels are separated into two elements, fuel system R&T and combustion R&T. Both of these R&T efforts rely on the "fuels and combustion fundamentals" activities for supporting research. The R&T and fundamentals elements will be described in subsequent sessions. The final element, consisting of systems analysis studies, is the culmination of the program. These will involve extensive economic and engineering trade-off studies to evaluate the effects of changing fuel properties on the overall fuel production and air transportation system.

A breakdown of the future fuels element, shown in figure 2, indicates four subelements or targets. The first of these is directed toward determining the range of probable properties of future fuels. Within this target an experimental in-house study is under way to investigate the effect of processing technique and severity on the characteristics of jet fuels produced from synthetic crudes. The in-house refinery studies have used a refinery model (ref. 1) assembled under a contract with Gordian Associates to study the effect of feedstock quality, refinery configuration, and product specifications on yield (ref. 2). An extension of this work will examine trends in aviation fuel refinery yields, cost, and energy consumption. A more extensive modeling activity has been under way at the University of California at Los Angeles for several years to generate projections of jet fuel supply and demand (ref. 3). This work will be described in a paper

later in this session. Eventually we plan to couple the refining and processing studies with studies of the effects of future fuels on aircraft and engine systems to identify trade-offs associated with changes in fuel properties.

The objective of the second target shown in figure 2 is to evolve improved correlations of fuel structure or composition with physical and chemical characteristics. The Colorado School of Mines is nearing completion of a research program to study correlations between organic nitrogen compounds and storage and thermal stability. This program as well as in-house studies in the area of thermal stability will be described in Session IV. With regard to physical properties, a research program was recently initiated at the Massachusetts Institute of Technology to derive improved correlations of freezing point and viscosity with fuel composition.

The third target in figure 2, analytical methods, consists of activities to identify and solve problems in characterizing broadened-property fuels. This work will also be described in a paper later in this session.

The final target involves the acquisition of test fuels which will be used throughout the various in-house and contracted fuels research projects. A workshop was held at the Lewis Research Center in 1977 to identify a referee fuel with broadened properties which could be used in test programs (ref. 4). This fuel, designated the experimental referee broadened-specification fuel or ERBS fuel has been procured and is described and characterized in reference 5. In addition, blending stock has been identified which can be blended with the ERBS fuel to produce a variation in hydrogen content with a minimal effect on other fuel properties.

The papers in this session cover a range of topics from current fuel trends to forecasts of future fuels and the utilization of shale-derived syncrudes. The presenters include representatives of nearly every major sector of the aviation fuel community, the fuel suppliers, the manufacturers, the airlines, and the Government. The material presented should not only identify the status and results of current activities, but also highlight areas where additional research is needed.

## REFERENCES


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## AIRCRAFT RESEARCH AND TECHNOLOGY FOR FUTURE FUELS

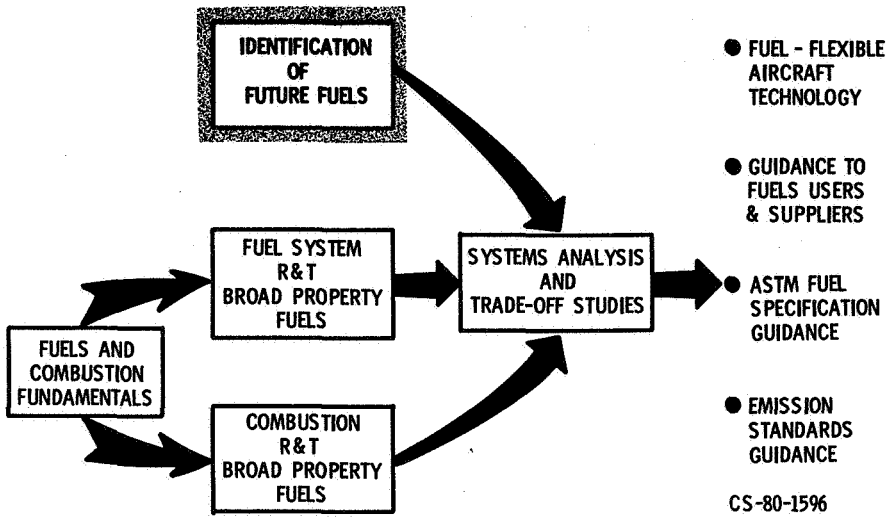


Figure 1

## NASA LEWIS ACTIVITIES DIRECTED TOWARD IDENTIFICATION OF FUTURE AVIATION FUELS

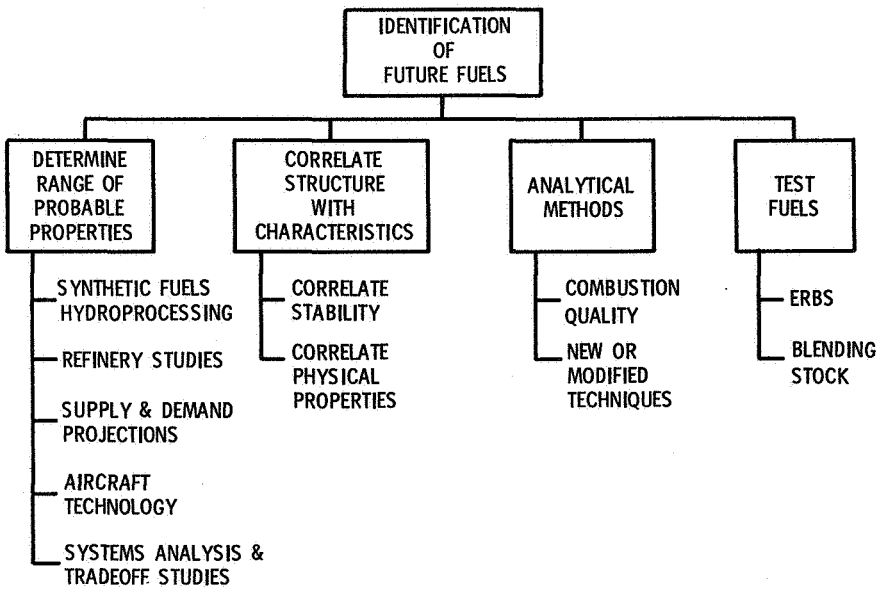


Figure 2